Prevention and Control of Coyote Predation

Alberta
AGRICULTURE
Crop Protection Branch
Agdex 684-10

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PREFACE

The purpose of this text is to provide farmers with a better understanding of the ecology of coyote predation in Alberta, as well as the ways and means to prevent, reduce or resolve predation of livestock by coyotes. This publication introduces you to the tools and techniques of coyote damage prevention and control. Methods used to identify coyote predation of livestock are also discussed.

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I. COYOTE AND OTHER PREDATOR CONTROL IN ALBERTA

Responsibility for the control of predator damage to livestock in Alberta is shared by Alberta Agriculture and Alberta Fish and Wildlife. In agricultural areas, coyote damage control is the responsibility of Alberta Agriculture. The Fish and Wildlife Division is responsible for damage by all other predators, including wolf, bear, fox, cougar, and eagle, as well as coyote predation in the forested unsettled areas of Alberta.

The coyote was declared a nuisance in The Agricultural Pests Act, 1984. This act permits farmers to remove coyotes with toxicants and devices approved and supplied by Alberta Agriculture. The act also allows landowners or occupants to shoot coyotes and destroy coyote dens on their property without a hunting licence.

The crop protection branch of Alberta Agriculture in cooperation with municipal agricultural service boards administers a provincial program for coyote damage control. You can obtain information, consultation, control materials and devices, and assistance in resolving predator problems from all rural municipalities.

Municipal agricultural fieldmen receive special training and instruction and are supplied with materials and devices to conduct coyote damage control. Request assistance from your agricultural fieldman. The fieldman may teach you to use restricted devices and materials to resolve your coyote problems.

II. COMPENSATION FOR PREDATION LOSSES

The Livestock Predator Compensation Program (LPCP) compensates farmers for livestock and poultry lost to predators or wild dogs. To qualify for compensation, a complainant must be a bonafide Alberta farmer who makes a significant portion of his or her income from raising animals for food. Losses must exceed $100 in market value in one calender year. Standard market values for meat animals are determined on a regular, routine basis. Horses and hobby animals do not qualify for compensation. Compensation for purebred and breeding stock is at the same rate as stock for slaughter.

The LPCP is administered by Alberta Agriculture. All claims are reviewed by one of two regional committees composed of government personnel as well as several livestock producers. Experts from other fields and investigating officers may be called upon as necessary.

IMPORTANT . . . evidence of predation

All claims for compensation must be investigated by qualified personnel. Fish and Wildlife officers, problem wildlife specialists, district agriculturists, municipal agricultural fieldmen, practising veterinarians, and RCMP officers are all qualified investigators. If one is not available contact another.

Evidence of predation is necessary before compensation can be paid. Therefore, you should preserve the carcass or what remains of the animal from flies, scavengers and predators until the investigator arrives. Cover the carcass with a tarp or burlap if it cannot be moved to a building or enclosure. The committee will almost assuredly reject a claim and pay no compensation if evidence of predation is lacking. If you report the loss as soon as possible there is a better chance that predation can be confirmed. Photos help document a predator kill. Take pictures of the carcass with the hide or skin peeled back to reveal damage beneath the skin that may not otherwise be observable (Figure 2). Photos of the kill site, signs of a struggle, blood, hair, and drag marks will serve as evidence of predation.

You can obtain more information from the publication *Livestock Predator Compensation Program* (Agdex 684-9) which is available from Alberta Agriculture.

III. RECOGNIZING A PREDATOR ATTACK

Determining the cause of an animal's death is not always easy. If you suspect predation contact the proper authorities immediately so that measures to prevent further losses can be taken.

You must often determine whether an animal was killed by a predator or died from disease or other causes and was eaten by a scavenger. The single most important evidence of predation is hemorrhage (bleeding) and bruises. An animal will only hemorrhage or bruise when it is alive or for a very short time after death (Figures 1 and 2). Check the carcass for external damage such as bite marks, punctures, lacerations, torn ears, nose or tail, and external bleeding.

Often damage may not be obvious on an animal with long hair or wool (Figure 1). Skin the hide from damaged areas or common points of attack (see chart) to determine if there is hemorrhage or bruises. These may be present even though no external damage may be apparent (Figure 2). Be sure to preserve all existing evidence for verification by an investigator so that you qualify for compensation.

Other signs of predation include torn turf, broken and flattened vegetation, drag marks on soil or vegetation, blood or pieces of tissue, and hide or bone on grass or brush. Alert, nervous livestock, calling and searching for their young may indicate recent harassment or attack by predators. Coyote hair on wire fences, fresh tracks and droppings may also confirm their presence.

Newborn and very young animals are particularly attractive to coyotes. About one-third of the calves that are killed by coyotes are only one day old. Newborn lambs are even more defenseless. However, lambs and calves can be stillborn or die of natural causes shortly after birth. These animals are often scavenged by coyotes. It is difficult to determine predation of newborn from the scavenging of stillborn. To do so, you must determine whether the lamb or calf walked, breathed, drank and was generally healthy before it was eaten by a coyote. Some of the clues to look for are as follows:

1. Did the calf or lamb walk?

   The so1e of the hoof of a newborn is covered by a soft membrane. This membrane wears off quickly when the animal starts to walk (Figures 3A-3D).

2. Did the newborn breathe?

   The lungs from an animal that lived and breathed will be pink in color, and feel light and spongy. In contrast, the lungs from a stillborn will be the color of dark wine and will not float in water (Figures 3E and 3F).

3. Does the newborn have a distinct blood clot at the umbilical cord?

   A blood clot at the umbilical cord indicates a live birth. Stillborn animals do not have this clot (Figures 3G and 3H).

4. Did the calf or lamb nurse?

   Milk in the stomach is another indication of a live birth (Figures 3I and 3J).

5. Was the calf or lamb healthy when it was born?

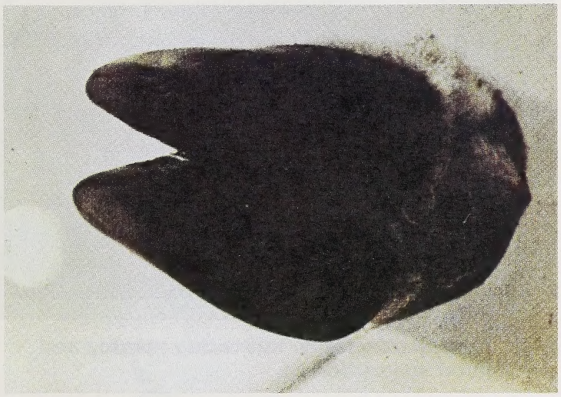
   A healthy animal will have fat deposits around the heart and kidneys and over the intestines. An unhealthy animal will have no fat deposits; these areas will appear red and gelatinous (Figures 3K and 3L).

Figure 1. Typical coyote kill with bites to the throat. Blood may not seep through the wool.

Figure 2. Bleeding, bruises and puncture wounds beneath the skin on a sheep killed by coyotes.

Figure 3. Postmortem evidence of live birth in very young lambs. (from Rowley, I. 1970. Lamb predation in Australia. C.S.I.R.O., Canberra).

3A and B. This lamb did not walk. The soft membrane remains on the bottom of the hoof.



3C and D. This lamb walked and wore away the soft membrane on the bottom of the hoof.

3E. Lungs are a dark wine color in a stillborn lamb.

3F. The light pink color of these lungs show that this lamb lived and breathed.

3G. Umbilical arteries lacking blood clots, indicating lamb was dead at birth.

3H. Distinct blood clots in umbilical arteries, indicating live birth.

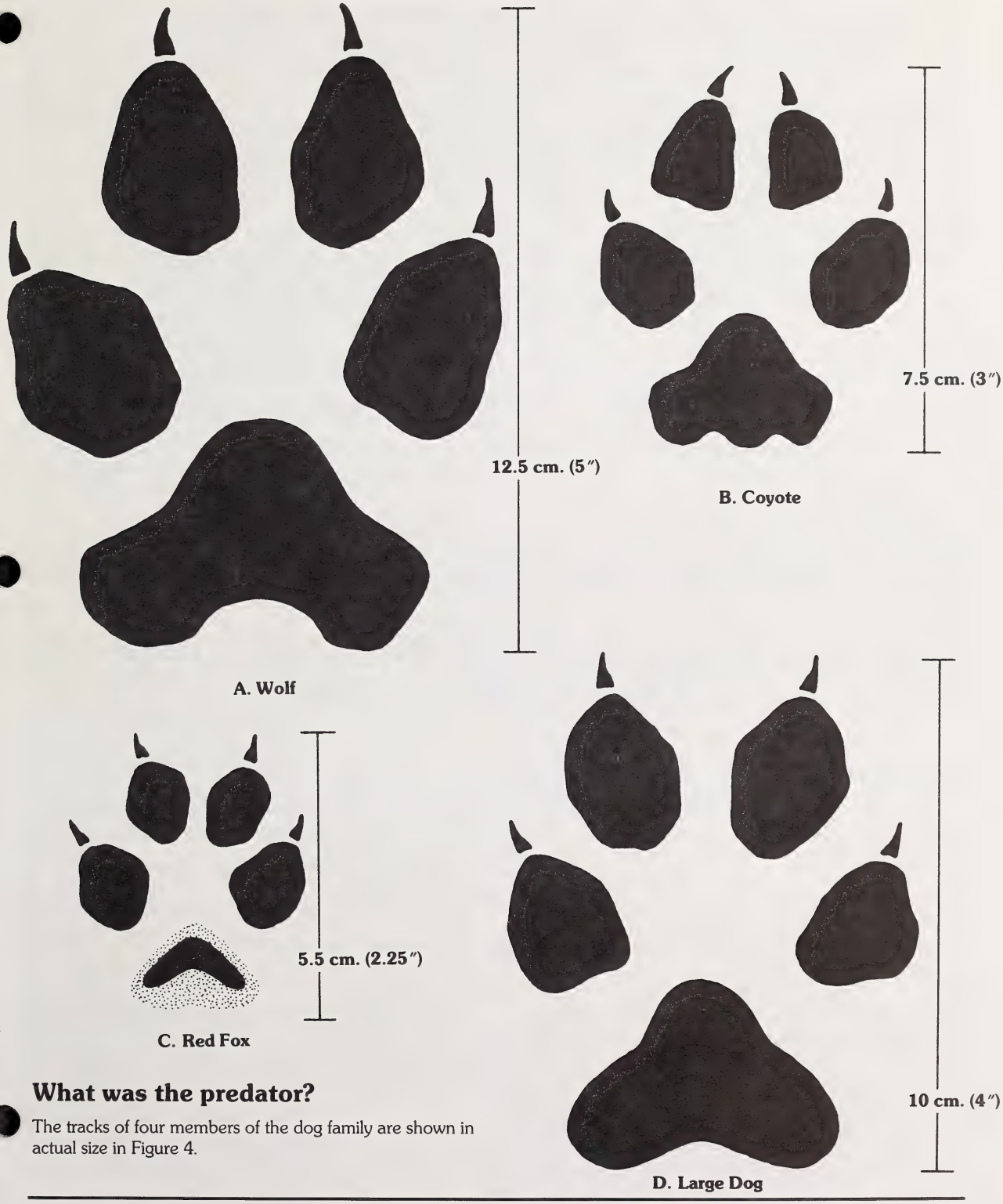
3I. Low quantity of milk in lower loop of gut, indicating inadequate nursing or absorption.

3J. Milk in intestines, indicating nursing and good absorption.

3K. Lack of fat around heart, indicating lamb may have died from starvation.

3L. Healthy fat desposit around heart of normal lamb.

Figure 4 Footprints of canid predators (actual size).



What was the predator?

The tracks of four members of the dog family are shown in actual size in Figure 4.

Characteristics of attack and feeding behavior of livestock predators.			
	DOG (domestic and feral)	**COYOTE**	**WOLF**
SHEEP	Attacks lambs and ewes, sometimes many at a time. Bites almost anywhere on the head and body. Often mutilates. Generally does not feed. Often 2 or 3 work in a group.	Usually bites throat behind jaw, suffocating sheep. Usually attacks one lamb at a time. Often consumes internal organs (liver, heart) first. May return to feed until entire carcass gone.	May kill many at one time. Attacks head, throat, abdominal areas. Carcass is usually completely consumed at first feeding.
CALVES	Uncommon. May attack one or two. Bites anywhere on head and body. Generally does not feed.	Bites neck, throat, flanks and hind end. Usually attacks one calf, often newborn and generally less than 1 month old. Usually consumes entire carcass.	May take 1 or more, depending on size of pack. Bites hindquarters, flank or shoulder. Broken or missing tail common. May return to feed.
COWS	Uncommon; packs of dogs may mutilate tail and hindquarters. Death results from being chased, especially during severe winter weather.	May be attacked when calving. Anus, vulva and udder eaten. Cow bleeds to death. Calf is also eaten.	Usually attacks 1 or 2 depending on size of pack. Bites on hindquarters, broken or missing tail characteristic. Often begins feeding on hindquarters, tail, anus. Will usually return to consume carcass.
PIGS	Attacks 1 or 2, usually feeders. Bites almost anywhere on head or body. Generally does not feed.	Usually attacks 1 animal, depending on size. Bites the neck, throat or shoulder. Will return to feed except when site is close to buildings.	Generally takes 1 or 2. Pigs may be missing. Wounds on neck, hindquarters, or shoulder.
HORSES	Uncommon; packs may chase colts. Injuries from barbed wire fences.	Uncommon.	Usually attacks 1 animal, of any age. Hindquarters attacked. Will usually return to feed. Usually involves a pack.
POULTRY	May kill from one to many birds. A large dog bites back or breast.	May kill from one to many. Generally removes the head, bites breast or back. Only partially consumes a few. May not return to feed. Usually will carry birds from kill site before feeding.	Uncommon — probably because of proximity of birds to farm yard.

Characteristics of attack and feeding behavior of livestock predators.			
	BLACK BEAR	**GRIZZLY BEAR**	**COUGAR**
SHEEP	Usually kills 2 or 3; occasionally kills many in a confined situation. Usually delivers blow to head, neck, back or ribs. Internal hemorrhage, severed spine common. May carry carcass to bush. May return to feed. May eat udder.	Usually kills 1 or 2. Kills with a blow to neck or back. Carcass generally consumed at first feeding.	Usually kills one animal. Bites on top of head and neck. Scratches on face. Feeds on abdomen, buries carcass, generally returns to feed. Edges of feeding sites are chewed very clean (no signs of tearing by teeth).

CALVES	Generally takes 1 calf. Bite and claw marks on neck and shoulders. May consume at first feeding, otherwise will return to feed.	Usually 1 or 2 calves. Kills as above. Carcass generally consumed at first feeding. Carcass often carried to cover. May bury carcass.	Usually takes one animal. Bites as above. Feeds after killing; covers carcass and returns to feed.
COWS	Occasionally kills yearling or adult or a cow-calf unit. Kills as above. Many claw marks. May cover carcass. Will return to feed.	Occasionally will take 1 animal. Kills as above. Fewer claw marks than a black bear. After first feeding will cover and return to feed.	Usually takes one animal. Bites neck, back and claws the face and nose. Covers carcass and returns to feed. Generally does not consume entire carcass.
PIGS	Usually takes several young pigs; sometimes a sow. Bites on back. May carry to bush or cover carcass. May return to attack again or to feed. Often begins feeding without killing individual.	As for black bear.	Uncommon.
HORSES	Unusual, except for occasional colt.	Unusual.	May attack colts.
POULTRY	Occasionally will enter chicken coop and kill many.	Rare.	LYNX: Will take many birds. Bites the back or removes the head. Generally returns to feed or kill again. Rarely attacks lambs and calves.

IV. BIOLOGY AND CHARACTERISTICS OF COYOTE PREDATION

Coyotes occur throughout Alberta and probably have benefited from the clearing of forests for agriculture. Coyotes can travel more easily on the hard-packed snow in open fields than on the soft snow in wooded areas.

Pocket gophers, ground squirrels, rabbits and mice make up about one-half of the coyote's diet, while carrion supplies about one-quarter. In winter, dead stock are a major source of food for coyotes.

Although deer, antelope and livestock are occasionally killed by coyotes, it is not known whether all or only certain individuals are potential stock killers. All coyotes can probably kill livestock but only a few do. However, once a coyote begins killing livestock, especially sheep, losses will usually continue until the livestock is moved, management is changed or the offending individual is removed.

Coyote predation of livestock can occur anywhere but tends to increase as forest cover increases in Alberta. Coyote predation of livestock is highest in the mixed forest region.

Coyotes prey on sheep far more often than on cattle. Lambs make up 71 per cent of all sheep killed by coyotes. Coyotes tend to prey on the smallest lambs in the flock, orphan lambs and lambs of old (broken-mouthed) or crippled ewes. Coyote predation on sheep varies seasonally in Alberta, being highest in summer (40 per cent) and almost nil (1 per cent) in winter. A considerable proportion occurs in spring and fall; 26 and 33 per cent, respectively.

Most coyote predation of cattle occurs during the calving season. Coyotes rarely attack healthy adult cows or yearlings. However, calves are often killed, and occasionally cows are killed during calving. About three-quarters of the calves killed by coyotes in Alberta are less than one month old and one-third are only one day of age.

From late January through late March, coyotes disperse from their depleted winter carrion sources. This is a period of extensive movement and mating. Coyotes give birth in late April or early May after a gestation period of 63 days.

The average litter size is 5 to 7, but may be higher or lower depending on food supply. Young are raised in dens which are often holes made by other species (badger, fox, skunk) that have been enlarged by coyotes. Pups begin emerging at 3 weeks of age and at 6 weeks are often playing outside the den. The female may move the den to a new location in midsummer, perhaps in response to human disturbance or to avoid a build-up of fleas in her home.

By late summer, pups accompany adults on hunting forays. The family usually remains together until October, at which time the juveniles begin to disperse from the parental home territory. Pups and yearlings may travel as far as 88 km (55 mi) to find a new territory. Yearlings may also disperse from July to November as well as during late winter.

In central Alberta, the home range of adults averages 12 km^2 (4.7 mi^2), but can be two or three times larger. Maximum diameter of home ranges varies between 1.6 km (1 mi) and 7.4 km (4.6 mi) and averages 4.2 km (2.6 mi). Adult coyotes tend to establish permanent home ranges, while pups and yearlings tend to wander before selecting a permanent residence. An injury such as a crippled foot may prevent an adult from establishing a permanent home range. Home ranges of resident coyotes overlap only slightly, while nonresidents wander throughout the area, but tend to avoid residents.

Coyotes sometimes crossbreed with domestic dogs, producing hybrids which can socially integrate with the coyote population. However, the breeding cycle of "coy-dogs" does not correspond with that of coyotes; hence the development of hybrid strains is unlikely.

V. PREVENTING PREDATION

There are many ways to reduce or eliminate predation losses to coyotes. Sometimes all that is required are changes in fencing or farm management practices. Like all predators, coyotes are opportunists and seek the easiest available food. If calves, sheep or poultry are readily accessible, coyotes will often kill them.

Farmyard carrion disposal

Carcasses of dead livestock, stillborn young and afterbirth attract coyotes, scavengers and other predators. Untreated carcass dumps or "bone piles" create attractive food for coyotes. These will encourage coyotes to lurk about and pose an ever-present menace to nearby livestock and poultry. To properly dispose of dead animals, burn thoroughly or bury to a depth of 2 m (6 ft) and cover with lime. In some areas dead stock can be taken to a rendering plant. Regulations of The Livestock Disease Act 1971, require the disposal of dead stock within 48 hours.

Flock and herd management

Cows and ewes that are about to give birth, particularly those with their first born, should always be confined. The smell of blood and the behavior of livestock during the birth process often attract coyotes. Ewes with lambs should be kept in the farmyard for at least two weeks after birth; cows with calves should be watched for at least one week particularly in the forested areas of Alberta. Ewes should receive high-quality feed so they will be strong and better able to defend their lambs or escape a predator attack. Lambs one to two months of age should be closely observed for about a month following placement on pasture. Often predation on very small lambs goes unnoticed.

Coyotes are keen to detect and attack sick or weakened animals. Old or sick animals should always be culled or removed to safe quarters to prevent predator problems. As previously mentioned, lambs from crippled ewes and lambs from ewes with broken mouths are particularly susceptible to predation.

Close confinement

Many sheep and goat producers pen their animals at night to prevent coyote predation. Predation is very common at dawn or dusk. Lighted corrals will aid surveillance of the flock but will probably not deter coyote predation. Many farmers also avoid pastures where predation is severe, at least until young animals are several weeks old. However, avoidance of certain areas may cause predators to shift their attention elsewhere.

Night confinement and the avoidance of pastures with a high risk of predation have some obvious costs and other costs that are not so obvious. In general, pastures and ranges are best utilized by more than one species of livestock; that is, cattle and sheep or goats. If sheep or goats cannot use a pasture because of coyote predation, the pasture will not be utilized to its full potential and you will lose or at least make less money.

Night confinement also requires more labor and more facilities. More importantly, lambs do not have as much time to graze if they are confined at night; lambs may not gain as much weight if they do not have free access to pasture. As an example, suppose that lambs with free access to pasture gain 0.3 kg (0.7 lb) per day while lambs in night confinement gain 0.1 kg (0.3 lb) per day. The difference in weight gain would require an additional 30 days in the feedlot to bring the semi-confined lambs to market weight.

Ewes may also suffer from night confinement and enter the breeding season in a poorer body condition which may in turn result in lower productivity; that is, fewer lambs per ewe.

Obviously, night confinement is not without cost. The cost of night confinement in a flock of 200 - 300 lambs may be the equivalent of losing a lamb every night or every other night. However, if predation is severe, night confinement may be the best choice, at least for a few days until other measures can be taken.

Herding

Herding sheep may help reduce predation in certain areas. However, because of the cost of a herder, and because coyotes may still attack herded sheep, the use of herders is only feasible where large numbers of sheep are run in a sing1e flock, where predation is severe, and where other alternatives are limited.

Conventional fences

The obvious purpose of a fence is to enclose and confine livestock to specified areas. A well-made fence can also act as a barrier to keep out coyotes and other predators. This is because coyotes usually do not jump over fences. They prefer to dig under or crawl through a fence.
Well-maintained and properly-built fences are essential to successful sheep production in Alberta. A good sheep fence should be constructed from mesh wire no less than 81 cm (32 in.) high, with one or two strands of barbed wire 15 cm (6 in.) apart above the mesh. In addition, a barbed wire just above ground level discourages coyotes from digging under the fence. Level the fence line before you build the fence. Leave enough space for a road along your fence for ease of inspection and repair. Again, coyotes prefer to go through or under, rather than over a fence. Thus, particular attention should be paid to brush patches, low lying areas, corners, and gates where there may be uneven terrain and gaps or holes under the fence. Routinely inspect, repair and keep fences in top condition.

Fences that are poorly constructed or poorly maintained offer coyotes direct and unrestrained access to pastures and livestock. Good fences channel the coyote's movements, and make coyote control much easier. Snares can be placed in the holes where coyotes dig under a fence; traps and cyanide guns can be placed along obvious trails.

Cattle and horses are very hard on mesh wire fences. They may stick their heads through the fence between the barbed and woven wire. Coyotes can easily jump through a fence where the mesh wire is stretched and flattened by cattle. An electrified wire just above the woven wire prevents fence damage by cattle and horses, adds years of service to the fence and aids in the prevention of coyote predation.

Electric fences

Electric fences have been used for many years in Alberta to confine cattle and repel black bears from bee yards. With recent innovations, electric fences have also proven successful in reducing coyote predation on livestock. A properly-constructed and regularly-maintained electric fence can provide an effective, nonlethal method of preventing predation.

How does a predator-proof electric fence work? A series of wires, alternating charged and grounded, are placed at pre-determined intervals on the fence posts. The charged wires carry current from the positive terminal on the energizer, and the grounded wires will return this current to the energizer's negative terminal. The circuit is not complete until a conductive object, such as a coyote, touches the wires. A shock is received when current flows through the conducting animal. Maximum shock is delivered when a coyote touches both a charged and a grounded wire. A shock is also delivered when a coyote contacts only a charged wire *(Figure 5)*. In this case, the soil acts as a conductor, carrying the charge to the nearest ground rod, up to the grounded return wire and back to the energizer. Shock intensity depends upon distance to the nearest ground rod and conductivity of the soil.

Conventional fences

A conventional sheep fence consisting of woven or mesh wire and two strands of barbed wire can be electrified if the woven wire and posts are in good condition. In many cases, predation may be prevented by a single electrified wire placed on the outside of the fence. A 12-gauge electrified smooth wire should be added to the outside of the fence, 15 cm (6 in.) above ground level.

When the mesh wire is on the outside of the posts, offset brackets will be needed to ensure adequate spacing between charged and mesh wires *(Figure 6)*. Coyotes attempting to dig under the fence will contact the charged wire and receive a shock.

If coyotes jump over the fence, add a third wire 15 cm (6 in.) above the top wire. If coyotes are suspected of jumping

through the fence, electrify the first and third wire above the mesh. Use insulators on all charged wires.

The woven mesh and second smooth wire act as ground wires and should be connected to the negative terminal on the energizer. All ground wires should also be joined together and connected to a ground rod at least every 540 m.

Seven wire predator fence

If a new fence is required or an existing fence needs to be replaced then the seven wire predator fence should be considered *(Figure 7)*. This fence is effective yet economical, costing roughly half the price of a conventional sheep fence. All wires should be 12.5-gauge, smooth, and high tensile. Proper wire spacing is the key to success.

Wire spacing from the ground up should be 15, 17, 17, 17, 20, 25, and 25 cm (6, 7, 7, 7, 8, 10, and 10 in.). This spacing is the maximum allowable for predator control. If the space between the wires is increased, coyotes can crawl through the fence without receiving a shock. All odd wires should be charged and all charged wires should have insulators. Use a single common wire to join the charged wires to the energizer. In addition, all charged wires should be joined every 1 km (0.6 mi) and on each side of a gate. This lowers the resistance of the electrical flow and provides a more even charge in each energized wire. To reduce the demand on the energizer, the top wire should not be charged until predation occurs. All even wires will be for ground return. Ground wires should be joined together and connected to a ground rod every 540 m. In dry conditions an additional grounded wire can be added 5 cm (2 in.) above ground level. This wire increases the chances of a coyote being shocked if it tries to dig under the fence.

Energizers

Many models of energizers are available. Look for one capable of producing 5,000 volts to a distance greater than the length of wire you will be charging. Remember, take all charged wires into consideration and not just the fence perimeter. Never overextend the capabilities of the energizer.

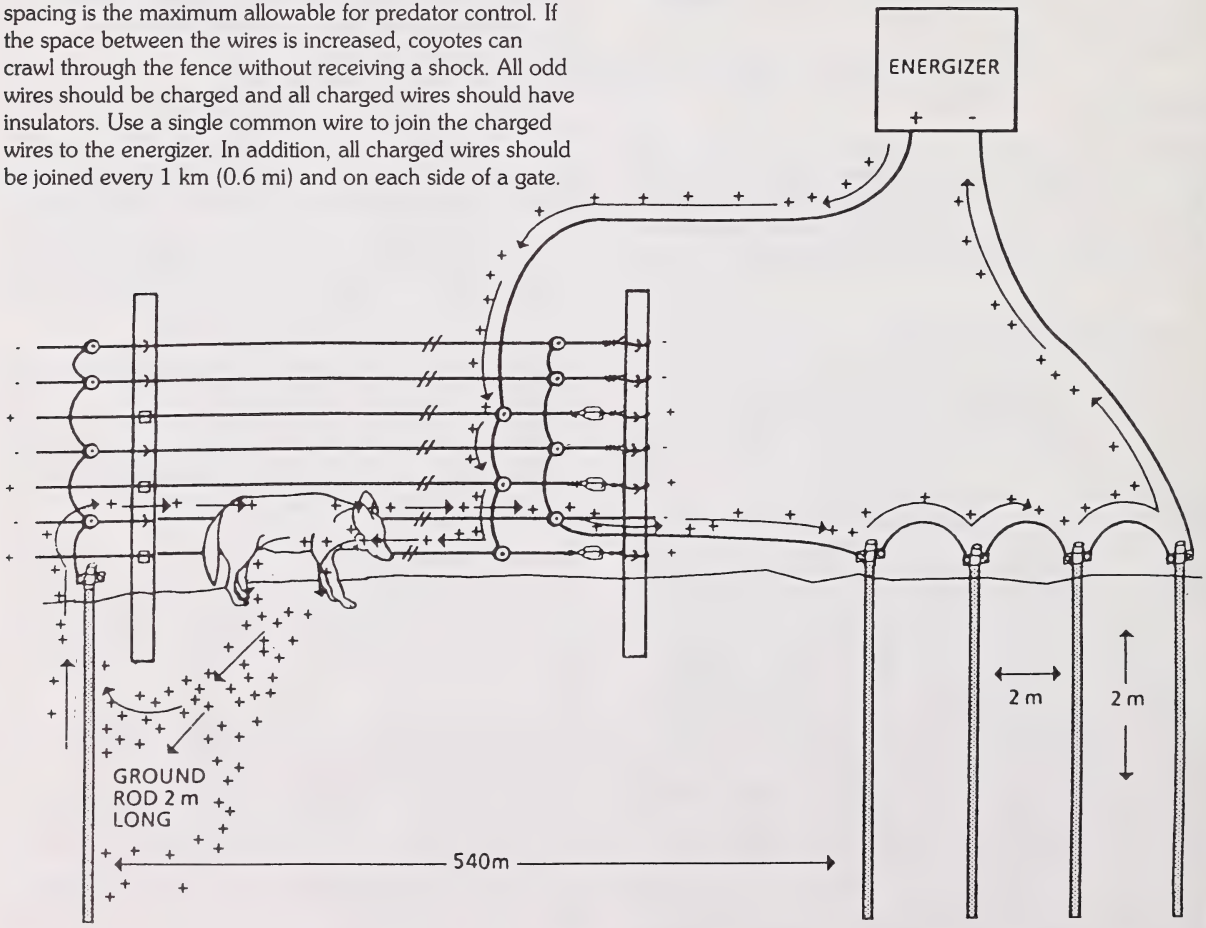


Figure 5. Current flow when a coyote touches an electric fence. Note the configuration of the ground rods and wires.

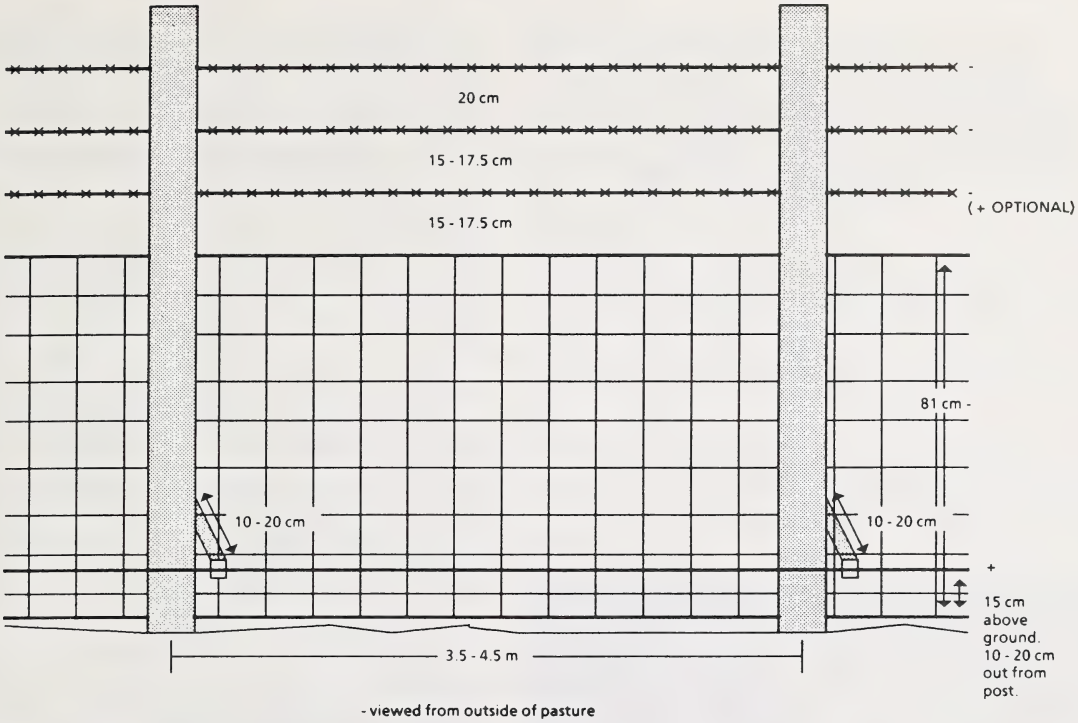


Figure 6. Electrified conventional sheep fence.

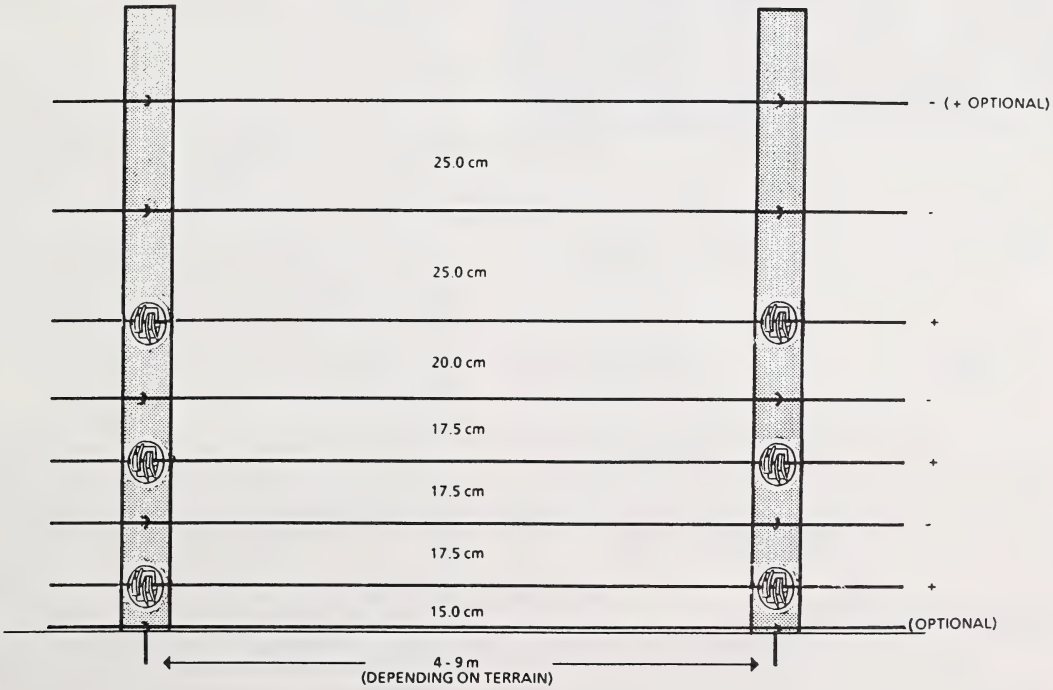


Figure 7. Seven-wire predator fence, viewed from inside the pasture.

Plug-in units are recommended, since no battery maintenance is required, and longer fencelines can be powered. Areas without a power source must rely on battery-powered energizers. Batteries should be industrial or the deep discharge type to handle necessary recharging. Optional solar-powered units are available for use in locations that receive consistent sunlight.

Remember:

- Always ensure the energizer is properly grounded and protected from the weather.
- Always install a lightning diverter.
- Never use more than one energizer on the same wire.

Wire

Fences should be constructed with 12.5 gauge, smooth, high-tensile galvanized wire. This wire has low electrical resistance, good strength and high visibility. It is also economical and lasts for years.

Barbed wire is not recommended because animals can become entangled in the barbs and receive repeated shocks.

Proper tension of all wires must be maintained at around 90 kg (200 lb). Because of seasonal variations in temperature and other factors, all wires require periodic adjustment. Placement of in-line tension adjusters on each wire at 0.8 km (0.5 mi) intervals will facilitate maintenance. Several types of tension adjusters are available.

Fenceline stress from overtension, such as caused by severe winter temperatures, can be alleviated by installing a spring assembly on each wire. Crimping sleeves should be used for permanently joining wires *(Figure 8)*. A splice using three crimping sleeves will be as strong as the existing wire. A crimping tool or pliers is required. Joining wires into a reef knot or figure eight knot is acceptable, whereas twisting wires together is not recommended *(Figure 9)*.

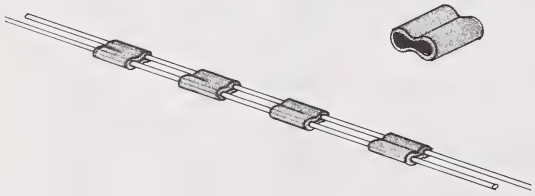


Figure 8. Wires joined by crimping sleeves.

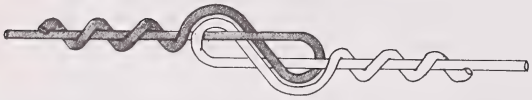


Figure 9. Figure eight knot.

A solderless connector or line clamp should be used for tapping into live wires or joining ground wires. These are easily installed and reusable. Again, twisting wire together is not recommended. Do not use connectors or clamps of dissimiliar metal because corrosion will occur at the join and impede electrical flow.

Insulators

Insulators are used for securing charged wires to posts. They prevent electrical loss from the charged wires to the post and soil. Without insulators, the voltage can be too low.

Always use insulators, even if the energizer you own does not require them. The benefit of maintaining maximum power far outweighs the small cost of insulators.

Insulating material is made of either porcelain or high-density plastic. A variety of insulators is available for line posts, corner posts and gates. Care must be taken with plastic tubing insulators, however, as water, dust and insects can enter the tube and cause corrosion.

Ground rods

All predator-proof fences must have properly-installed grounding systems. Two separate grounding systems are required: one directly connected to the energizer ground and the other connected at 540 m intervals to the fence line (Figure 5).

The energizer ground is composed of four galvanized rods or pipes driven at least 2 m (6 ft) into the soil. Each ground rod should be spaced 2 m apart. Using a common wire, attach the ground terminal of the energizer to all ground rods and return wires on the fence. The fenceline grounding system uses only one ground rod driven next to the fence every 540 m. Each rod should be long enough to be driven 2 m into the soil, leaving a length above ground for wire attachments. Then, using a common wire, join the ground rod to all ground return wires (Figure 5). A ground rod clamp can be used to attach the common wire to ground rods. If possible, drive all ground rods in damp areas or low spots.

Gates

Gates do not have to be electrified if openings within the gate are no larger than 10 cm (4 in.) and the gate is constructed high enough to discourage jumping by coyotes. A wooden sill placed under the gate will prevent predators from digging. To continue the electrical current from one side of the gate to the other either carry the wires overhead on a crossbar or bury them underground. If installed underground, then bury at least 30 cm (1 ft) deep, encasing the live wires and ground wires separately in 12 mm plastic pipe. Ensure all ends of the plastic pipe above

ground are bent downwards to keep water out. Apply caulking material to the ends of the pipe for a thorough seal.

Construction and maintenance

Regular monitoring and periodic maintenance of the electric fence system is necessary to ensure the fence retains peak operational efficiency. However, maintenance can be reduced if the initial design and construction of the fence has been carefully followed. This includes the following:

1. Proper preparation of the fence perimeter. Leave sufficient space along the fence for vehicle access for inspection and maintenance. The ground should be levelled, and all trees, branches and debris removed along the fenceline. Vegetation cover below the fence must not interfere with the bottom wires. Application of residual herbicides will eliminate all vegetation below the fence. A mixture of paraquat for prompt suppression of vegetation, and bromacil, for long term control, has proven effective. Re-treatment is not normally necessary for at least two or three years. Aspen and willow can be suppressed with 2,4-D.

2. Fences must be installed to specifications. Taking shortcuts could reduce effectiveness. Ensure posts are secure. Charged wires should be insulated and joined with proper connectors. The ground system must be properly installed and all wires should be tightened to 90 kg.

3. Maximum power must be maintained to the fence. Purchase the proper energizer for your needs. Replacement parts should be readily available if the energizer breaks down. In addition, the energizer battery must be regularly recharged.

Periodic inspections should also include checking voltage in the wires at various distances around the fence. To maintain effectiveness, fence voltage should never fall below 3,500. By using a voltmeter, the voltage at various locations can be quickly determined. If voltage leaks are found, they can be corrected.

Remember, up to 3,000 volts are required to adequately shock long-haired animals such as coyotes.

You can obtain additional information on electric fences and fence construction in the following publications from Alberta Agriculture:

- *Electric fences for livestock predator control.* Agdex 684-7
- *High-tensile smooth wire fencing manual for Alberta.* Agdex 724-3
- *Electric fencing manual for Alberta.* Agdex 724-4

Guard dogs

The use of a guard dog can be an effective, nonlethal method of preventing coyote predation of sheep and other livestock. It does, however, require a sincere commitment of time and patience by the owner to develop the full and proper guarding potential of the dog.

Breeds

Guard dogs have been used for hundreds of years to protect livestock in Europe and Asia. There are several different breeds of Old World guard dogs.

The Great Pyrenees *(Figure 10)* is the most familiar, having been raised for show and pets during the past 50 years in North America. As its name implies, the dog originated in the Pyrenees Mountains between France and Spain. The Pyrenees is one of the best choices for a guard dog and can be used on rangeland as well as pasture grazing conditions.

Figure 10. The Great Pyrenees.

The Hungarian Komondor *(Figure 11)* is another popular breed of guarding dog. These large white dogs have a unique coat that somewhat resembles a mop. Like most other guarding breeds, they are relatively large, with adults sometimes weighing in excess of 45 kg (100 lb). Research in Idaho has shown these dogs to be quite successful with pastured sheep, but not a good choice for large bands of sheep herded on unfenced range.

Other less common breeds include the Akbash and Anatolian Shepherd from Turkey, the Shar Planinetz from Yugoslavia, the Kuvasz from Hungary and the Maremmas from Turkey. Individuals from each of these breeds have been used successfully to guard livestock.

The pup

Before you buy a dog, become familiar with the overall concept of livestock guarding dogs. A guard dog may not be appropriate for some operations and even a successful dog may not adequately solve a predation problem.

Figure 11. The Hungarian Komondor.

You will be most successful if you start with a pup about seven to eight weeks old. Purchase a pup from a reputable breeder, preferably one who has sold working dogs previously. Select a pup that appears confident.
Neither sex has proven superior to the other. Make certain the dog is free from physical problems. Most breeders will certify their dogs free from hip dysplasia, and some will even guarantee replacement for a dog that fails to perform properly.

Training

Place the new puppy immediately with lambs or whatever livestock it is eventually expected to protect. Ensure that the lambs do not harm the dog. The puppy may need a small enclosure within the sheep corral where it can get away from the lambs. Periodically observe the dog, particularly during the first several days. The object of this rearing process is to develop a bond between pup and sheep. This association is important and may determine the success or failure of a dog later in life. The pup and lambs usually get along well together. Lambs may allow a pup to groom them. However, a pup will occasionally become too playful with the lambs, and may even injure them. This excessive play behavior should not be tolerated. Therefore, it is important to watch a pup during socialization to ensure that excessive play is strongly discouraged.

Once a bond is formed between the dog and the sheep, even a four to six-month-old pup will remain with sheep if it's encouraged to do so. Since a pup's bond to sheep can easily be overshadowed by a bond to people, it is important to determine at the outset how rigid the requirement for staying with sheep is to be. If sheep are kept near the farmyard, a dog will likely include people in its guarding routine; its bond to sheep need not be as absolute as it would be in an operation where the sheep are kept some distance from the headquarters. In contrast, strong bonding to sheep is essential if a dog must protect sheep that are 1-2 km or more from the house.

Feeding the dog and placing a dog house in the pasture where the sheep are kept will help maintain the bond between the dog and sheep. Since most sheep will readily eat dog food, some system for keeping the sheep away from the dog feeder should be devised.

Once a dog is mature and has proven its trustworthiness, it may be allowed access to all phases of the livestock operation. The degree of freedom allowed a dog is strictly left to your discretion. Since each dog's temperament is different, each operation must be handled in an individual manner.

There are several approaches to take when a pup or adolescent dog becomes too playful with lambs. One is to simply remove the dog from the sheep or tie it when it can't be supervised. Simply preventing a situation from becoming a problem is easier than trying to change an established behavior. An alternative is to place the dog with larger sheep or more aggressive rams that won't tolerate the dog's playful antics. Usually the overly playful period is outgrown and the best solution to the problem is to keep the dog suitably supervised until it matures.

The mature dog

Once sheep are accustomed to a guard dog, they accept the dog as a member of the flock and usually only respond if the dog barks or runs through the flock in the course of its guarding routine.

Physical encounters between guard dogs and predators are relatively rare. A coyote would not normally fight with a dog that is three or four times its weight and has the capability to wound or kill.

Guard dogs are effective in keeping predators away from sheep by a combination of behaviors. A guard dog is very mobile, patrolling the area around the sheep and investigating an intruder or a disturbance. In the course of patrolling, a dog scent-marks. This behavior, typical of the dog family, is used to denote a territory or convey other information. Guard dogs will also usually bark in response to a disturbance. In most situations the actions of patrolling, scent-marking and barking alert coyotes to the presence of the dog. Most coyotes will then seek food elsewhere.

Research in Idaho has shown that about 75 per cent of the dogs can be successful guardians. However, there is a variety of problems associated with using these dogs to protect sheep. The most serious occurs when a dog injures or kills a sheep. Although the number of dogs that kill sheep is small (14%), it is still a serious problem. Harassing and eventually killing sheep may result from boredom, especially in immature dogs confined with sheep in a small area. Rehabilitation is possible for dogs that inadvertently kill sheep during playful behavior. However, dogs that continue this behavior will obviously not be suitable flock guardians.

Mortality of guard dogs is an important consideration. Dogs may be shot if they wander; others may be maliciously shot by trespassers. Placing a large dog with sheep is not a traditional practice in North America. In many areas, dogs that are seen unattended and suspected of harassing livestock are shot.

Dogs can be killed by poisons and devices used for coyote control. Extreme care must be taken to protect dogs from control measures. Only coyote getters, traps, snares and toxic collars should be used on pastures where there are working dogs. Dogs should be confined and temporarily removed from the area when these devices are used.

Some dogs are hit by vehicles and others die from health problems. Some may become overly aggressive to people; this should be considered by farmers using this form of predator management.

No single method of predation control is universally effective and guard dogs are no exception. For some farmers, dogs are an excellent method. A growing number of farmers are finding that a guard dog complements their program of predator management. However, for some, dogs have not been effective. For instance, guard dogs may not be useful where sheep scatter widely in very large pastures.

For the livestock industry, a number of prevention and control techniques must be available to minimize depredation. Guard dogs deserve serious consideration.

Frightening devices and repellents

Coyotes are wary and sensitive to changes in their environment. Thus, the presence of any unusual sound, sight or smell may keep coyotes away from an area for a few days. Propane exploders, sirens, distress calls, lights, scarecrows, a vehicle in a pasture, or a radio can be used to deter predation for at least a short time. This may give you a chance to initiate predator control and adopt permanent changes in management.

Coyotes and other predators quickly adapt to such devices and soon overcome their fear. For best results use a number of different frightening devices and techniques at the same time. These devices should be changed frequently so coyotes do not become accustomed to them. For example, the volume should be changed on a radio, a vehicle should be moved to a new position in a pasture, and the clothes should be changed on a scarecrow.

A wide variety of chemical repellents and deterrents has been developed to repel coyotes from livestock. Most are taste or odor offensive and are applied in a variety of ways; for example, body sprays, collars and ear tags, odor stations along fences and aversive chemicals placed in food baits. While some may work temporarily, no single chemical repellent works well enough for general use. Thus, chemical repellents are not recommended for coyote control in Alberta. Similarly, taste aversion with lithium chloride and other chemicals has not been proven effective and is not recommended as a preventive technique.

VI. LETHAL CONTROL

Philosophy and policy

Alberta Agriculture recognizes that while the coyote can be a nuisance to agriculure, it is also a valuable species. Coyotes prey on rodents, consume carrion, and provide fur, recreation and enjoyment to many people. These attributes counterbalance their sometimes destructive habits of attacking domestic livestock and poultry. Landowners and occupants are allowed to hunt coyotes and destroy dens at any time on their own land. In many instances, hunting or denning by the landowner (or others with the owner's permission), coupled with good livestock management practices, will reduce livestock predation losses.

Where coyote predation cannot be prevented or reduced by hunting, fencing and other preventive techniques, farmers may receive assistance from municipal or provincial personnel and/or be granted permission to use restricted devices for coyote control. This permission will normally be granted in instances where verified losses are occurring. Permission may also be granted for preventive control in winter on farms with a history of predation. However, farmers must also take reasonable precautions to prevent predation. Predation on pets, unconfined poultry or animals raised as a hobby can usually be prevented by changes in management and rarely justifies the use of poisons or other devices.

Regulations of The Agricultural Pests Act, 1984, permit certain authorized individuals to use approved snares, traps, 1080, strychnine and cyanide shells for coyote control. All of these devices and poisons are potentially dangerous to humans and other species. Their use must be kept under strict control and limited to instances of necessity rather than convenience. Use of devices and poisons by unauthorized personnel shall result in prosecution under The Agricultural Pests Act, 1984.

Farmers may be granted authorization to use restricted devices and poisons on their own land in instances of specific verified predation of livestock and poultry or for preventive control in late winter on farms with a history of predation. Authorization where granted shall be for a specific period of time and will be subject to the following conditions.

The farmer shall:

a) Agree to use Alberta Agriculture poisons and devices in accordance with Alberta Agriculture policy, the regulations of The Agricultural Pests Act and The Pest Control Products Act (Canada). You may not use or manufacture your own snares, cyanide shells, poison or other devices.

b) Be trained in the use of poisons and devices and demonstrate an ability to use them in a safe responsible manner.

c) Store and handle poisons in a safe manner to ensure against loss, theft and accidents.

d) Agree to use these poisons and devices only on your own land. Poisons and devices cannot be given to others nor set on someone else's land.

e) Return all unused devices in a specified period of time, and report the results of the control.

The amount of poison issued generally shall not exceed the maximum permitted per predation site specified in the Pest Control Products label. Rather, the amount of poison issued will be limited to the minimum necessary for the specific problem. Poisons should not be issued to provide the farmer with an "inventory" to take care of potential predation which could occur later.

Most livestock predation does not occur when pelts are prime, so requests to use restricted devices during the pelting season will be closely examined. Farmers may be allowed to salvage pelts where applicable, but extra scrutiny will be maintained when pelts are prime to ensure that protection from predation is the primary motivating factor.

All locations where devices are in use will be available to Fish and Wildlife officers, RCMP, public health officials and other official jurisdictions upon request. Fish and Wildlife officers may check warning posters, currency of authorization and location of devices to minimize or prevent the use of illegal devices on land where no authorization to use poisons or devices has been issued.

Precautions and safety (READ THIS !!!)

The use of poisons and devices for coyote control is a privilege, not a right. If you and other farmers in Alberta use poisons in a safe, responsible manner, you will probably be able to use them for a long time in the future. If you do not use them properly, you will not only jeopardize your own privileges but those of others as well.

One accident could result in the prohibition of all poisons and devices for coyote control.

Please read and observe the following precautions and safety measures:

1. Do not use poisons or other coyote control devices until you are trained and *understand* how they work, how they should be used and the precautions required for their use.

2. Read all the documents given to you, including the Pest Control Products labels.

3. Memorize the first aid instructions. It may be too late to refer to them after an accident has happened.

4. Store poisons and other devices in child-proof containers at all times out of reach of children, pets and livestock. These containers should be stored in a locked box if the poison and other devices are not used immediately.

5. All containers should bear the appropriate warnings, poison stickers and labels. A skull and cross bones is mandatory.

6. Always wear gloves when handling coyote poisons. Reserve these gloves for that purpose only.

7. Place warning posters at all entry points to the land on which the poison has been placed. Warning posters should be placed on all gates. Posters should also be placed on both sides of a stream where it enters and leaves your property.

8. Keep a record of all bait locations.

9. Set poisons and devices no closer to occupied dwellings, cities, towns or villages than specified on the Pest Control Products label. Strychnine and 1080 baits, cyanide guns and snares shall not be set nearer than 0.8 km (0.5 mi) from any city, town or village nor closer than 0.4 km (440 yd) from any inhabited dwelling excluding that of the person setting the bait or device. Toxic collars can be used no closer than 0.8 km from any city, town or village.

10. Remove and dispose of poisons and devices as specified on the Pest Control Products label. Strychnine and 1080 baits can be set for no longer than 15 days, while cyanide guns, toxic collars and snares should be removed after 30 days. Baits should be destroyed by burning or burial to a depth in excess of 30 cm (1 ft).

11. Inform your neighbors that coyote control materials are being set on your property. This is not required by any law nor by Alberta Agriculture policy. It may, however, go a long way toward keeping peace in the neighborhood and avoiding accidents.

Hunting and shooting

Shooting

Good equipment and practice can enable most farmers to use shooting as an effective method of predator control. Since coyotes are usually seen at a distance, it is important to practise shooting at a comparable-sized target at various distances. Use a flat-shooting rifle (for example, a .243, .250/3000, 25/06 or .270) with an adequate scope (4-power or higher). Sight the rifle to hit a 8-10 cm (3-4 in.) target at 135-225 m (150-250 yd). Carry a firearm in your vehicle or on your tractor and be prepared for an encounter with a coyote.

Calling and shooting

Coyotes can be called with a predator call and shot. However, practice is necessary because the predator may be scared away rather than attracted.

There are several types of calls for predators. The predator voice mimic can be either a sharp coyote bark or a yapping call that elicits a barking response. A predator call can also mimic an injured or dying coyote. If this call is used near a den where pups are present, an adult may soon investigate. More popular is the prey distress call, which mimics a rabbit or fawn in distress.

You should call as close as possible to the area where predation occurred. The coyote may be attracted by the call early in the morning, as it returns to the carcass to feed. Use a well-camouflaged blind with a good view so you can shoot without moving. Haystacks, brush piles, buildings, old farm machinery and car bodies provide good hiding places. A very windy day is not good for calling, because your scent may be detected by the coyote or your call may not be heard. On a calm day the call may be heard for 0.8 km (0.5 mi) or more.

Face downwind when calling. When coyotes respond to a call, they usually circle and approach upwind. When the animal is sighted, do not repeat the call until it is apparent that the coyote cannot locate you. If the coyote is moving away from you, some coaxing, low-volume calls may bring it back. Some coyotes remain hidden, unwilling to break cover; intermittent calls may eventually bring them into the open.

If you shoot and miss, remain still, as the coyote may not know where the shot came from and may not run away. Some coaxing calls may again bring the animal towards you. If the animal sees you, however, it will run away, and you may as well move to another location.

If you shoot a coyote, remain in the blind for a few minutes and call for other coyotes that may be in the area.

If no response is received after 15 minutes of calling, move at least 0.8 km (0.5 mi) before calling again.

A shotgun with either number 2 or 4 shot can be used for close bushwork; a rifle sighted for 270 m (300 yd) should be used in open areas.

Trapping

Trapping is a very selective technique, useful in almost any predator situation. Many producers consider trapping to be better left to the skilled artisans of the fur trade; this is an unfortunate attitude. With practice and proper instruction, most people can become proficient enough to trap offending predators on their land.

Equipment

Equipment required for trapping includes:

- Number 3 or 4 double-spring coyote traps
- 0.6 - 0.8 m (1.5 - 2 ft) anchor pins
- Chip or claw hammer
- Gloves
- Kneeling pad made of canvas or an old coyote or cow hide
- Pan covers of light canvas large enough to cover the entire pan on a trap
- 5 cm (2 in.) cubes of foam rubber
- Kitchen sieve or can with holes punched in the bottom

The trap chain must be securely fastened to an anchor pin with a small clevis, cable clamp or several wraps of haywire.

Ensure that all equipment used is free of unnecessary human or other odors. Traps and anchor pins should be treated in a hot water mixture containing logwood bark and trap wax. This process darkens, descents and helps prevent rust. Traps treated in this manner can be used many times before they must again be treated. This is an important step, because coyotes are very sensitive to human odors.

Trap sites, baits and scents

You must first locate a good site for trap replacement. Where the trap is placed is as important as how well it is set. You have various choices of where and how to set your traps:

1. Trails used by coyotes near a predation site are ideal.
2. Set a trap where coyotes are going under or through a fence *(Figure 12)*.
3. Coyotes, like domestic dogs, mark their territory by urinating and defecating at various spots. Trapping at these scent posts is very effective.
4. Traps should be set in the vicinity of a predator kill as soon as possible. Avoid touching or moving the carcass. Do not place your traps too close to the carcass. Coyotes are normally cautious and suspicious near a

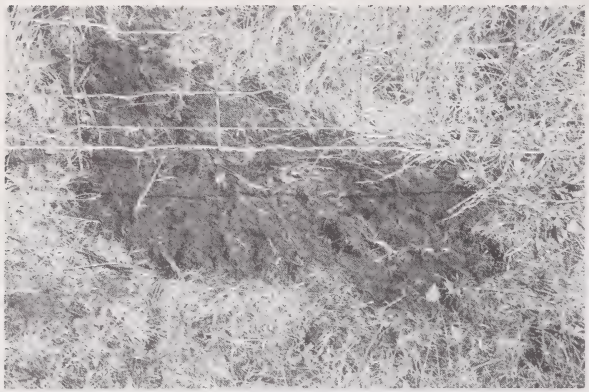


Figure 12. A coyote trail under a fence.

carcass and are more likely to detect a trap. Set your traps 20 m (20 yd) or more from the carcass on trails used by approaching coyotes.

5. A dig hole, which mimics a rodent's burrow can also be used *(Figures 13 and 20)*. Bed your traps 30-45 cm (12-18 in.) from the bottom of the hole. Carefully cover your traps with leaves, soil or grass.
6. A "bone pile" set is also popular. Two or three traps are set 0.3 -1 m (1-3 ft) from a bone pile. Coyote scent is placed on some of the nearby bones. This site may be used again after the first coyote has been captured. The scent of the captured coyote will often attract others.
7. In winter, a mound of soil 1 m (3 ft) high protruding above the snow is a natural attraction for coyotes. Two traps set on top of the mound, with or without scent, should suffice.
8. Coyote trails along edges of sloughs, beside brush patches, or in fields near brush make good trap sites.
9. A concealed unbaited trap can be set under a thin crust or layer of snow on a travel route. This is called a "blind set" because no scent is used.

Coyotes can also be attracted to trap sites using prepared food baits or lure attractants. An artifical dig hole or scent post can be effective using these lures *(Figure 13)*. Scent lures or food baits are essential and should be placed on nearby vegetation, stumps and stones.

The best food lures are meat or fish which have been cubed, placed in a jar and "ripened" by burying for a week or more. Chicken heads, fish or parts of carcasses can also be used. Most commercial lures contain some coyote urine. Coyote urine can be collected from the bladder of a dead coyote with a hypodermic syringe. Food baits and lures can also be purchased commercially from trappers' supply outlets.

Trap setting procedures

On a trail set, try to locate a spot where a coyote must step over a small log or other obstruction. The trap should be

Figure 13. A dig hole set. The dig hole is in the center; traps are in the lower left and lower right corners. The traps should be covered with grass, leaves or soil.

positioned about 20 -25 cm (8-10 in.) on either side of the log and off centre of the trail. Try to select a natural depression as the trap will then be easier to camouflage.

Setting procedures are as follows (Figures 14 A-F):

1. At the trap site, remove the soil to a depth of 2.5 - 5 cm (1-2 in.) so the trap sets just below ground level. The hole should be the same shape as the trap when it is set (Figure 14A). Use the kneeling pad when you are setting the trap to minimize scent and disturbance at the site.
2. Place the pan cover in the trap and then set the trap. Ensure that the pan cover is positioned over the trap pan and under the trap jaws (Figures 14B and C).
3. Once set, rotate the trap springs toward the pan dog (or trap trigger) until the jaws lie level (Figure 14B). Slip the 5 cm (2 in.) cube of foam rubber under the pan. This will prevent the trap from firing if a small bird or rodent touches the trap pan.
4. Drive the anchor pin into the ground its full length in the centre of the trap bed or just to the side of the trap as shown in Figure 14D.
5. Carefully place the trap into the prepared depression. Tuck the excess trap chain alongside the trap spring.
6. The trap should be positioned so the coyote steps into the trap from the direction of a trap spring, rather than from the side of the trap. That is, the coyote should approach the trap from the left or right of the trap as shown in Figure 14D. If a coyote steps into the trap from the side, the coyote's foot can be pushed upward either by the jaw or the pan dog when the trap fires. The results may be a capture by the toes rather than a proper catch across the foot pad.

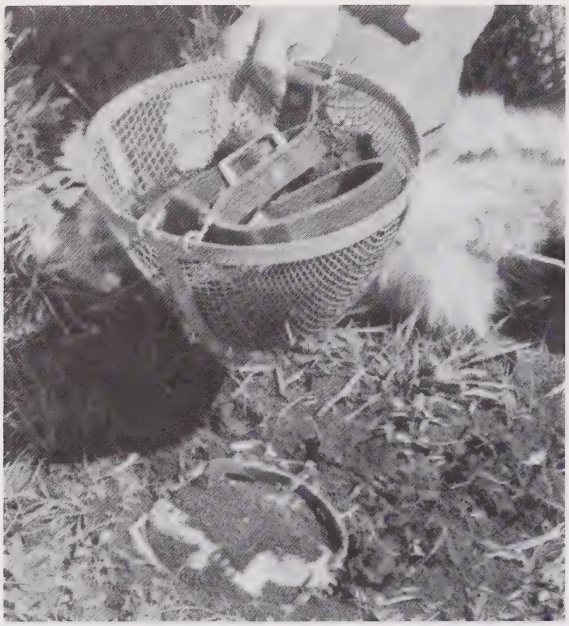
Figure 14. Trap-setting procedures. A-F

14A. Remove soil to depth of 2.5-5 cm (1-2 in) Note dry coyote skin used as setting cloth.

14B. Place the pan cloth in the trap. Place a piece of foam rubber the size and shape of the pan underneath the pan (not shown).

14C. Make certain that the pan cloth covers the entire pan.

14D. Set the trap in the prepared depression. Drive in an anchor pin for its entire length (0.6-0.75 m (2-2.5 ft) — note top of pin next to long spring.



14E. With sieve, replace the soil over the trap.

14F. Cover the trap with leaves and grass.

7. Carefully cover the trap with leaves, grass and fine soil until the trap is perfectly hidden (Figure 14E). After covering the trap, the site should appear as natural as the adjoining ground (Figure 14F).
8. Remove the kneeling pad and remaining equipment from the site.
9. Bear in mind that coyotes are extremely sensitive to any foreign odor. Always wear gloves that are not contaminated with an unusual odor and use a cloth or hide for kneeling. Never smoke or spit near the trap. As you depart, brush out your tracks with a spruce bough or tree branch.

Follow-up

Inspect your traps early each morning. Daily inspections are important not only for humane reasons but also because a coyote trapped improperly by one or two toes may eventually escape and become trap-shy. If the set is to be reused, blood should be cleaned up immediately. Never skin an animal at the trap site if the site is to be used again.

Trapping books, available at trappers' supply outlets and libraries, contain various types of trap sets that may be adapted to control coyote damage.

Restrictions and precautions

1. Traps may not be used without a) a resident's trappers licence, b) a permit from Alberta Fish and Wildlife Division, or c) proper authorization from Alberta Agriculture.
2. Notify adjoining landowners when setting out traps.
3. Do not be set within sight of a travelled road.
4. Inspect daily, and not later than every 48 hours.
5. Do not set for longer than 15 days.
6. Maintain a record of trap site locations.
7. Set to minimize nontarget capture.

Lethal neck snares

Neck cable snares have been used for years by registered trappers to capture furbearing animals, especially coyote, wolf and fox. Set properly, these snares can be very selective. Snares are harmless to birds but will take deer and farm animals if set improperly. Do not set snares on game trails as this will increase the chances of catching nontarget animals.

You must use proper snare cables, locks and swivels. If inferior equipment is used, the coyote can chew off the snare and escape with a wire loop around its neck, to die a slow death.

The length of the snare should be extended with haywire. A snare should have a swivel or eyelet on the end of the cable opposite the loop. Thread two pieces of haywire

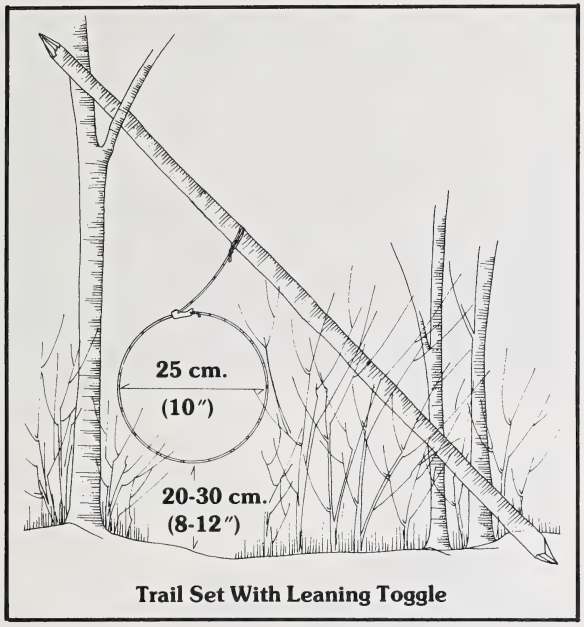


Figure 15. Coyote snare set.

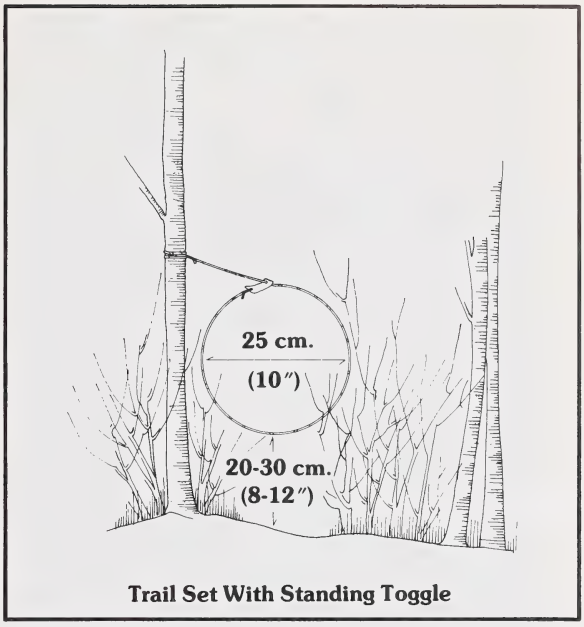


Figure 15. Coyote snare set. (Continued)

about 1.3 m (4 ft) long through the eyelet and bend the wire back on itself so the snare is actually held by four strands of wire 0.6 m (2 ft) long. The snare can then be secured by wrapping the haywire around a tree, post or wires of a fence.

Snares are set along known coyote trails immediately above the animals' tracks *(Figure 15)*. No bait or lure should be used, as this will keep the animal's nose close to the ground and it will not become ensnared.

Coyotes that enter a pasture by digging under the wire can be taken with a snare encircling the hole *(Figures 16 and 17)*. The snare should be set on the same side of the fence from which the coyote is expected to approach, normally the outside of the fence. Secure the snare to the wire fence by the haywire on the end of the snare. Do not make the snare loop too small within the hole, as it will be more easily detected by coyotes.

Keep the loop to the outside of the hole and allow 5 cm (2 in.) of space between the bottom of the snare and the ground. As the coyote pushes through the hole, his feet will pass under the snare and his head will pass into the snare loop.

The outline of the snare can be concealed by lightly wrapping dry grass around the loop.

On a trail set, the snare can be secured to either a green tree or a 2 m-long green pole standing vertically near the trail. The tree or pole should be at least 8 cm (3 in.) in diameter. Do not put the snare on a dead tree or pole, because the tree or pole may break or be chewed completely through by a coyote.

If a tree is close to the trail, secure the snare by wrapping the haywire several times around the tree. The haywire should be attached securely to the tree, but the wire should also be loose enough to allow the haywire to slip around the tree to prevent the coyote from twisting the wire off.

The haywire should act as an arm upon which the snare is hung. The height and position of the snare loop can be adjusted by bending the haywire up, down or sideways. The snare loop diameter should be 25-30 cm (10-12 in.) and the bottom of the loop should be 22-30 cm (9-12 in.) above ground level.

The snare loop can be stabilized by lightly wrapping a thin strand of wire between the snare arm and the loop. This will prevent the loop from accidentally closing.

To break the outline of the snare, small branches can be erected on the outside edge of the loop; grass or other vegetation can be loosely wrapped from the tree along the snare arm.

As with all control techniques, do not leave unnecessary signs or odor at the site. Avoid stepping on the trail. Cigarette butts, footprints, spit and urine may also frighten coyotes from the site. Wear clean gloves when you handle and set snares. Be sure your shoes are not contaminated with grease, oil or other material that may leave an unfamiliar odor for the coyote.

Figure 16. A snare on a fence. Note the coyote trail.

Restrictions and precautions

1. Snares may not be used without proper authorization from Alberta Agriculture. You must comply with all provisions of The Agricultural Pests Act, 1984, and regulations.

2. Only snares issued by Alberta Agriculture and marked with serial numbers shall be used.

3. Do not set closer than 0.8 km (0.5 mi) from any city, town or village nor closer than 0.4 km (0.25 mi) from any inhabited dwelling excluding that of the farmer with predation problems.

4. Do not set within sight of a travelled road.

5. Maintain a record of snare locations.

6. Inspect daily, and not later than every 48 hours.

7. Do not set for longer than 30 days.

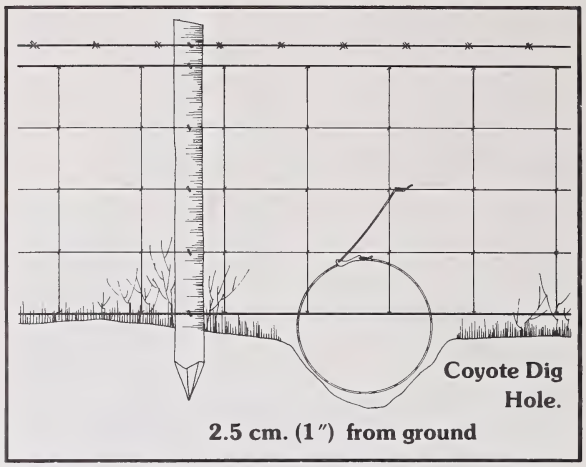


Figure 17. Snare set under a mesh wire fence.

Coyote getters

Method of operation

The coyote getter or cyanide gun *(Figure 18)* is a mechanical device that, when bitten and pulled, propels poison into a coyote's mouth. A trigger mechanism activates a firing pin. The firing pin strikes a .38 calibre shell casing loaded with cyanide powder. The powder is ejected out of the shell and into the coyote's mouth through the force of a shell primer and a small amount of pistol powder. The cyanide powder is converted to cyanogas in the animal's stomach and kills quickly, most often in less than a minute.

Steps in setting a coyote getter

The parts of a coyote getter *(Figure 19)* and associated equipment are as follows:

Stake (A): a pipe-like part, flattened on the bottom end. It is driven into the ground flush with ground level and holds the firing mechanism. A trip mechanism attached to the side of the stake acts in releasing the trigger on the firing mechanism.

Firing mechanism (B): contains a spring-loaded firing pin which strikes the primer of the shell casing when fired, and causes the cyanide powder to be discharged. The top part is threaded to accept the prepared cyanide shell. The firing mechanism is fitted into the stake, with the trigger placed under the trip mechanism.

Setting tool (C): used to depress the firing pin and spring of the firing mechanism. To cock the mechanism the trigger must be lifted while the firing pin is depressed.

Figure 18. Coyote getter or cyanide gun.

.38 Calibre shell casing (cyanide shell) (D): contains a primer, a small amount of pistol powder and cyanide powder.

Shell holder (E): a metal part (E(1)) threaded on the bottom, designed to hold the cyanide shell. This becomes a prepared cyanide shell (E(2)) after being wrapped with cotton batting and bonded with paraffin wax. The cyanide shell is inserted in the shell holder. The prepared cyanide shell is attached to the firing mechanism.

Lures (F): placed on the prepared cyanide shell. The lure causes the coyote to bite and pull on the prepared cyanide shell which in turn causes the coyote getter to fire.

Hammer and driving pin (G): used to drive the stake into the ground.

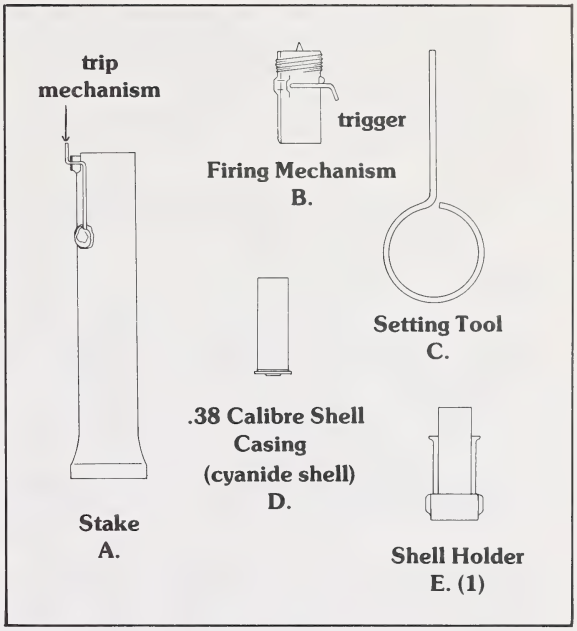
The setting procedure is as follows:

1. Avoid accidents!! *Always wear safety glasses, a heavy-duty dust mask and gloves* to protect yourself in case a coyote getter is accidentally discharged.

2. Always wear gloves kept only for coyote control. Your gloves will reduce the amount of scent left on a coyote getter. Make as little contact with the ground as possible.

3. At a selected site, clear a 30 cm (1 ft) diameter spot by removing tall grass and other debris. Also scratch up the site with your hammer. This tends to attract the coyote along with the food lure on the coyote getter.

4. Remove the firing mechanism (Figure 19B) from the stake. Then drive the stake into the soil until it is flush with ground level. Use a driving pin at least 12.5 cm (5 in.) in length or you may damage the top of the stake and trip mechanism (Figure 19A). Remove the driving pin.



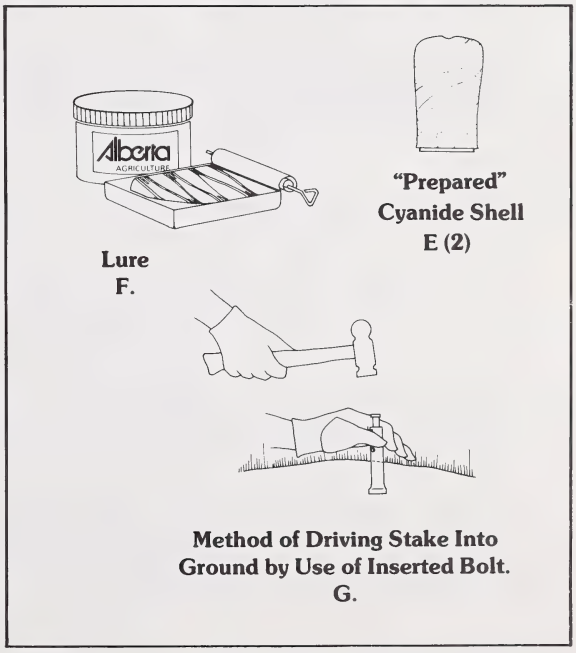


Figure 19. Coyote getter components and associated equipment.

5. Cock the firing mechanism by firmly pushing the firing pin down with the setting tool (Figure 19C) and locking it in set position by lifting the trigger (Figure 19B) located on the side of the firing mechanism. The firing pin is cocked when the trigger is in a horizontal position.

6. Place the cocked firing mechanism into the stake ensuring that the trigger is hooked under the trip mechanism located on the stake.

7. From an upwind position and using an out-stretched arm, carefully screw the prepared cyanide shell (Figure 19E(2)) onto the firing mechanism. Always exert a light, downward pressure when you attach or remove a prepared cyanide shell from the firing mechanism, as an upward pull causes the cartridge to fire. Always keep your face away from the coyote getter when a cyanide shell is attached. Never work directly over the coyote getter.

8. Apply a food lure to the prepared cyanide shell. Alberta Agriculture lure is normally used, although homemade and commercial lures can also be used effectively. Lure should be applied with downward strokes to prevent accidential firing of the device.

9. To be safe, always remember the following precautions when you attach or remove the prepared cyanide shell: (a) Stay upwind; (b) wear gloves, safety glasses and a heavy-duty dust mask; (c) use an outstretched arm; (d) exert a downward pressure; and (e) keep your face away from the device.

10. Check coyote getters at regular intervals. Remove and replace fired cartridges and reapply lure as needed.

    The top of the prepared cyanide shell will be frayed and open on a coyote getter that has been fired. However, you should always assume that a coyote getter is loaded. Carefully unscrew the prepared cyanide shell from the firing mechanism using a downward pressure. Inspect the primer to determine if the shell has been fired.

11. Remove all coyote getters as soon as coyote problems have been resolved or not later than 30 days after placement. Safely store and return all control material and components to the issuing inspector.

Placement of devices

As with traps, snares and baits, proper placement of coyote getters will greatly influence your success. Study the situation carefully before placing a coyote getter. Try to locate the travel routes and direction from which coyotes are coming into the pasture. One well-placed set is often better than several poorly-located ones.

A trail set is commonly used for coyote getters (Figure 12). A hill top or knoll also makes a good site. Place one or two coyote getters along livestock trails, fencelines, hedge rows or on the edge of a field.

Place the coyote getter off to one side of a sheep trail to prevent sheep from stepping on it. If possible, do not set coyote getters where cattle or horses have access to them. These animals occasionally lick at the applied food lure and may cause the device to fire. They could be killed.

A kill site is a good location to set a coyote getter. Remove the livestock carcass and replace it with a coyote getter. A coyote will usually find the device and pull it.

Always keep a written record describing the location of coyote getters. Make the description as detailed as possible so you can find the getters again. You may have trouble finding the coyote getter without a distinctive landmark. Place a rock, a large piece of wood or a tree branch five paces north (south) of the getter. Find the rock or piece of wood and then find the coyote getter.

Restrictions and precautions

1. Coyote getters may not be used without proper authorization from Alberta Agriculture. You must comply with all provisions of The Agricultural Pests Act, 1984, and regulations.

2. Only coyote getters and shells issued by Alberta Agriculture and marked with serial numbers shall be used.

3. Do not set closer than 0.8 km (0.5 mi) from any city, town or village nor closer than 0.4 km (0.25 mi) from any inhabited dwelling exlcuding that of the farmer with predation problems.

4. Post warning signs.

5. Maintain a record of coyote getter location.

6. Do not set for longer than 30 days.

7. Store coyote getters and shells in a locked container.

First aid

Prevention is the best policy. Always wear safety glasses, a heavy-duty dust mask and gloves when you are working with coyote getters. Stay upwind. Never work or stand directly over a coyote getter. Always assume that coyote getters are loaded, like all other firearms.

Strychnine and compound 1080 baits

Strychnine and compound 1080 baits

How poisons work

Strychnine enters the blood very rapidly and acts on the central nervous system. The time between ingestion and onset of symptoms depends upon how full the stomach is and the type of food eaten. Symptoms may appear 5-30 minutes after ingestion. Strychnine acts on the nervous system and causes convulsions that lead to respiratory failure. Strychnine is not cumulative, and is not absorbed through normal intact skin.

Compound 1080 (sodium monofluoroacetate) interferes with the energy-producing cycle within the cells. There is a symptom-free period of 0.5-2 hours or more between ingestion and onset of symptoms. Symptoms include nausea, vomiting, diarrhea and very active behavior leading to convulsions. The affected individual simply runs out of energy. It is not absorbed through normal intact skin.

In comparison to strychnine, 1080 is more selective for members of the dog family and less hazardous to people and other nontarget species. Consequently, 1080 is probably a better choice for coyote control.

Strychnine and 1080 are extremely toxic chemicals and are potentially dangerous to people, wildlife and domestic animals. Nontarget poisoning can occur if strychnine and 1080 are used improperly. However, the chances of nontarget poisoning and accidents can be minimized if poisons are set properly and all safety precautions are followed.

Strychnine and 1080 are restricted chemicals and cannot be used for coyote control without authorization specified in The Agricultural Pests Act, 1984 and regulations.

Baiting techniques

Strychnine and 1080 are available in tablets. Each tablet contains enough poison to kill one coyote; that is, it contains a single lethal dose of poison.

Strychnine and 1080 tablets can be used in two ways:

1. A single tablet can be placed in an individual, bite-sized piece of meat weighing less than 100 g (less than 4 oz). This is the preferred method and will be called an "SLD bait" (a single lethal dose bait). In comparison to larger baits or a whole carcass, coyotes tend to pick up SLD baits more quickly. There is also less chance of poisoning other species if certain procedures are followed.

   SLD baits are often placed around a large carcass. The carcass is called a "draw bait" because it attracts coyotes to the site.

2. One to five or six tablets can be placed in a coyote-killed carcass. This should only be done when the carcass is relatively fresh; that is, less than one day after death. Otherwise the carcass should be used as a draw bait for three to five SLD baits placed in the immediate vicinity.

SLD (Single Lethal Dose) baits

What makes the best SLD bait? One strychnine or 1080 tablet placed in a small, bite-sized (less than 100 g) piece of meat makes an SLD bait. Chicken heads make an excellent bait; the beak should be opened and the tablet placed in the throat. Chicken heads are preferred because they are not readily consumed by ants, carrion beetles, or mice. The skull makes an effective bait even after the head is dried out or stripped of flesh by insects.

Soft meat (hamburger, liver, flesh) does not make good SLD baits except during cold weather because they can be quickly eaten by mice or insects.

Raw eggs can be used. Make a small hole in the end of the egg with a knife and insert one tablet. Seal the opening with lard, fat or tape. Be sure to place a lure or odor attractant on the egg because an egg may not have much scent. Chicken eggs make a good bait because they generally cannot be broken by animals smaller than a skunk.

Coyote lure or attractant is usuallly placed on or close to SLD baits. Ordinarily, the SLD bait is covered with vegetation, manure or soil and the coyote lure is placed on vegetation within a few cm (in.) of the bait.

Lures are usually made from strong-smelling ingredients that attract coyotes to the site. Common components of lure include coyote urine, rotten meat, fish oil, beaver castor, skunk or mink musk, and wintergreen oil. Alberta Agriculture provides a lure made primarily from beef brains and salmon oil. Many commercial lures are also available.

Bait sites. One to six SLD baits should be placed in areas where coyotes frequent. A kill site make an excellent and obvious place for SLD baits. Place SLD baits from 2-15 m (2-15 yd) or more from the carcass if it is still present. SLD baits should be used wherever possible because coyotes tend to pick up the smaller baits before feeding on a larger carcass. Thus, SLD baits make for more effective coyote control. They are also easier to pick up and destroy than a poisoned carcass after control has been completed.

Occasionally, a kill site cannot be used because it may be too close to a road or buildings. The carcass should be moved to a new location where poison can be used. Place the bait near an old bone pile, on a knoll or hill top, along a

trail, or in an open area 50-100 m from a creek or tree line. Baits placed immediately adjacent to a creek or tree line are frequently taken by nontarget species so these areas should be avoided.

If the carcass of a coyote kill is not available, a draw bait of some other type should be used (a beaver carcass, dead poultry). Draw baits attract coyotes to the site and increase uptake of SLD baits.

Bait to minimize nontarget poisoning. If bait is consumed by a nontarget animal, the animal will be needlessly killed and the bait will not be available for coyotes. Thus, SLD baits should always be set to minimize nontarget poisoning. It doesn't seem to matter to a coyote whether a bait is covered by vegetation, manure or soil; all seem equally attractive. However, the way that a bait is set can affect uptake by nontarget animals:

1. **Birds** will almost never pick up a bait if it cannot be seen from above. Thus, SLD baits should always be covered with vegetation, manure or soil to prevent nontarget poisoning of birds.
2. **Insects,** particularly carrion beetles and ants, can consume SLD baits very quickly. Cover the SLD baits with a shovelful of chicken manure. Carrion beetles are attracted by the ammonia given off by rotting flesh. The ammonia from the chicken manure apparently masks that of the bait and reduces or prevents bait consumption by insects.
3. **Mice,** on the other other hand, are attracted to the feathers and grain in chicken manure. Where mice are a problem, baits should be covered with vegetation, cow manure or soil. Chicken eggs might also be used where mice and insects are a problem; mice and insects can not break a chicken egg.
4. **Cattle** are frequently attracted to a dead carcass or draw bait. They may also be attracted to some coyote lures, particularly those that contain fish oil. Cattle may trample SLD baits that are covered only with vegetation or manure. Baits in cattle pastures should be covered with soil. If a draw bait or carcass is used, SLD baits should also be placed at least 15 m (15 yd) from the draw bait, to reduce the chances of a bait being trampled.

   A gopher-hole set mimics the burrow of a prairie gopher or ground squirrel *(Figure 20)*. Dig a hole about 5 cm (2 in.) in diameter and about 15-20 cm (6-8 in.) deep at an angle into the soil. Place the bait in the hole and cover with 7-10 cm of soil. Place a coyote lure near the hole. Rodent burrows are often investigated by coyotes. Thus, the hole set offers a visual attractant for coyotes as well as protects the bait from cattle. Cattle may still trample the site but the bait will rarely be exposed.

Figure 20. A dig hole or gopher hole set.

Draw baits and livestock killed by coyotes

Draw baits should be used to attract coyotes to a bait site. However, poisons should not be placed in draw baits when SLD baits are used. A poisoned draw bait will only marginally increase poison uptake by coyotes and may increase nontarget poisoning, particularly of birds.

Coyotes will usually consume SLD baits before a draw bait is touched. Thus, SLD baits should always be used around a carcass or draw bait. SLD baits may be placed from 2-15 m (2-15 yd) from the draw bait unless cattle are present; SLD baits should be placed at least 15 m from the draw bait in cattle pastures to avoid trampling.

A predator kill can be poisoned with three to six strychnine or 1080 tablets less than one day after death. However, the carcass should be positioned so that a minimum of flesh is exposed. Poison should only be placed in areas protected by intact hide or on the underside of the carcass *(Figure 21)* to minimize hazards to birds.

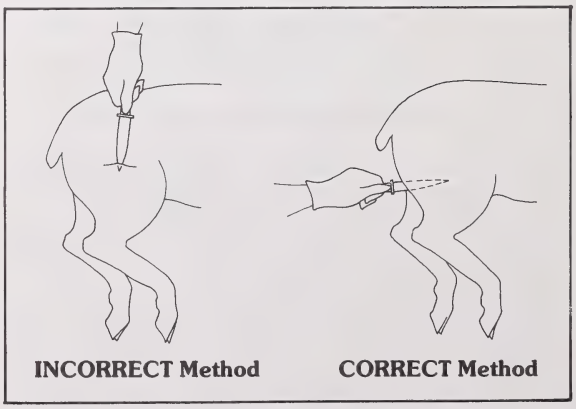


Figure 21. Strychnine or 1080 pellets inserted into a carcass.

A poisoned draw bait may be justified where SLD baits are rapidly consumed by mice or insects. However, a poisoned draw bait should be buried to reduce the probability of nontarget poisoning and delay decomposition by maggots and warm temperatures.

Restrictions and precautions

1. Strychnine and 1080 are restricted chemicals and may not be used without proper authorization from Alberta Agriculture. You must comply with The Agricultural Pests Act, 1984, and regulations as well as The Pest Control Products Act labels.
2. Only strychnine and 1080 issued by Alberta Agriculture shall be used.
3. Do not set closer than 0.8 km (0.5 mi) from any city, town or village nor closer than 0.4 km (0.25 mi) from any inhabited dwelling excluding that of the farmer with predation problems.
4. Post warning signs.
5. Maintain a record of bait sites.
6. Do not set for longer than 15 days.
7. Bury or burn baits after control is completed.
8. Store poisons under lock and key.

First aid

Strychnine. If less than 10 minutes have passed since the poison was taken, induce vomiting by inserting a finger in the throat or by giving 25 mL (1 tbsp) of salt in a glass of water. If symptoms of poisoning have begun, avoid vomiting as this may lead to the inhalation of vomitus. Enforce absolute quiet and an absence of stimuli. Have the patient lie down in a darkened, quiet room if possible; keep the patient warm and quiet and call a physician immediately.

Compound 1080. Speed is essential. Immediately induce vomiting by inserting a finger in the throat or by giving 25 mL (1 tbsp) of salt in a glass of water. Repeat until vomit fluid is clear. Then give 30 mL of epsom salts in water. Have the patient lie down; keep warm and quiet. Call a physician immediately.

Toxic neck collars

The toxic collar kills coyotes that attack sheep. This technique exploits the coyote's habit of killing sheep and goats with bites to the throat and neck. A coyote will actually suffocate a sheep or lamb with numerous bites to the throat that eventually collapse the windpipe. The toxic collar has two sealed, rubber bladders that contain a solution of water and compound 1080 (sodium monoflouroacetate). The bladders are firmly attached to two velcro straps *(Figure 22)*. Collars are placed on sheep or lambs so that one bladder is on each side of the throat just under the jaw *(Figure 23)*. A coyote that attacks collared sheep will usually bite and puncture the collar, and receive a lethal oral dose of poison.

Poison is delivered only to those coyotes that attack sheep. Thus, the toxic collar minimizes hazards to coyotes not involved in livestock predation and other nontarget species.

Collars are made in a large size for big lambs and ewes and a small size for smaller lambs. They are filled with 60 and 30 mL of 1080 solution, respectively (10 mg of 1080/mL). The collars are placed on the neck of sheep just below the jaw. Velcro straps are fastened on top of the head. One strap fastens behind the ears and the other in front of the ears to hold the collar in place *(Figure 23)*. These straps

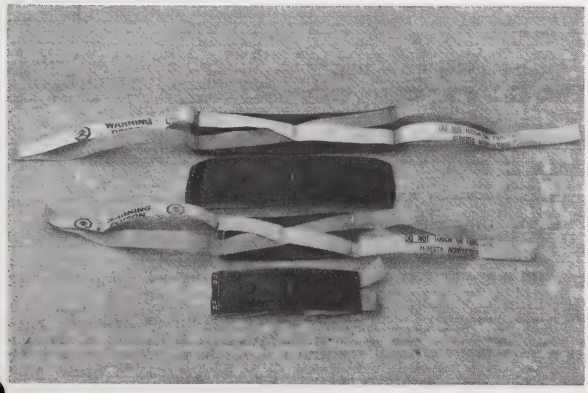


Figure 22. The toxic collar consists of two rubber bladders and two velcro straps. There is a large and small size.

Figure 23. Toxic collar on a sheep.

should be stapled together in two different places to further secure the collars on the sheep. The straps should not be too tight or they may cause sores on the skin beneath the collar.

A coyote will receive a lethal dose of poison during approximately 75 per cent of the attacks on collared sheep. The key to success is flock management to ensure that collared sheep are attacked. Ideally, all lambs should be collared. However, if you have more than 25 lambs, herd management is usually required so that all lambs need not be collared. Ewes need not be collared if lambs are present because coyotes prefer lambs.

In large flocks, 5-20 lambs and their mothers should be separated from the main flock. These lambs should be collared. This target flock should be left in the field where the most recent predation occurred. The main flock should be moved to a different field and corralled at night.

You should consider the following points when a target flock is established:

1. The toxic collar works best on healthy, thrifty lambs over 14 kg (30 lb). When attacked, a big healthy lamb struggles more and increases the chance of a collar being punctured by the coyote.
2. Collars are most efficiently used after a pattern of normal coyote predation has developed. About 3 coyote attacks within 2 weeks are required before a predation pattern can be determined. You should then be able to better determine where the collared lambs should be placed and for how long. However, you need not wait until three attacks have occurred before using the collars.
3. Toxic collars work best in the spring when predation is more regular and throat kills are more common.
4. Collared sheep should be checked daily. Collars should be adjusted as required. A search should be made immediately for missing lambs and collars. Attention to detail will increase your chances of success.
5. Changes in the size or distribution of a flock may deter coyote predation for a week or two. Be patient. Collars should be removed and returned to your agricultural fieldman if no predation has occurred after 30 days.
6. Accurate records of toxic collar use must be maintained. All collars should be numbered and all numbers recorded.

As with other control techniques, there are disadvantages to the toxic collar:

1. Some collared lambs will be killed by coyotes because 1080 does not kill immediately. The first symptoms of 1080 poisoning do not usually occur until two or more hours after the poison is ingested.
2. Increased labor is required to collar and monitor target animals and manage the flock to direct coyotes to the collared sheep.
3. The main flock must be moved to another pasture and/or confined at night.
4. A pattern of predation should usually be determined before collars are used. They work best where coyotes kill regularly, as for example every 1-3 days. If a coyote kills only occasionally, the labor and time required to resolve a predation problem can greatly increase.
5. Collars are ineffective if coyotes do not attack the throat. About 25 per cent of the sheep are killed by an attack on parts of the body other than the throat.

The effects of toxic collars on nontarget animals and the environment have been evaluated in the United States and found to be minimal or negligible. Nontarget primary and secondary poisoning has not been demonstrated. There is a potential for nontarget poisoning of scavengers if they eat the neck of a dead collared lamb. However, most feeding takes place on the body of a dead lamb rather than the neck. Prompt disposal of dead lambs will minimize nontarget hazards.

Some collars may be lost; these pose a potential threat to people. However, it seems unlikely that anyone would ingest the liquid from a collar after it has been on a sheep for more than one day. Regardless, you should do your best to find lost collars.

Like all other coyote control techniques, the toxic collar is more useful in some situations than in others. It is the most selective and safe way to use poisons for coyote control. They may be effective where coyotes will not take bait or coyote getters. They may also be appropriate where extreme care must be taken, as for example, where working dogs are present. The toxic collar can be a valuable tool for coyote control.

Restrictions and precautions

1. Toxic collars may not be used without proper authorization from Alberta Agriculture. You must comply with The Agricultural Pests Act, 1984, and regulations as well as The Pest Control Products Act labels.
2. Post warning signs.
3. Inspect each collar at least once a week to insure that it is properly positioned and not broken.
4. Collars shall not be used nearer than 0.8 km (0.5 mi) from any city, town or village.
5. Remove collars after 30 days.

First aid

Speed is essential. Immediately induce vomiting by inserting a finger in the throat or by giving 25 mL (1 tbsp) of salt in a glass of water. Repeat until vomit fluid is clear. Then give 30 mL of epsom salts in water. Have the patient lie down and keep warm and quiet. Call a physician immediately.

Den hunting

Den hunting in the spring is an effective method for preventing or controlling predation of lambs and calves. The time you spend den hunting in April, May and June may reduce predation losses and the time required for coyote control later in the summer. Den hunting works best in southern Alberta where there is less tree cover and dens are generally easier to find. However, once found, dens tend to be easier to remove in northern Alberta where they are closer to the surface, about 1 m (1 yd) as compared to southern Alberta where they may be as deep as 5 m (16 ft).

During spring and early summer pups will be in the den. The female may also be there, but spends less time in the den as the pups grow older. The male is often nearby.

A den is often within 3 km (2 mi) of a coyote kill. Dens are almost always within 180-360 m (200-400 yd) of water and often on a high spot such as a coulee bank or edge of a ravine. They may, however, be on the flat prairie or in an abandoned beaver dam. Search the area where you see coyotes in the daytime. Look for tracks, a well-worn path, and large well-used holes. There may be feathers, wool, droppings, flattened grassy patches and digging around the mouth of an active den.

Equipment necessary for den hunting includes:

- a sharp, long-handled spade
- a powerful flashlight
- a shotgun with number 5 or 6 shot shells
- a sharp probing bar about 2.5 m (8 ft) long
- 3-6 m (10-20 ft) of gassing hose and a gasoline vehicle without anti-pollution devices; or sulfur dioxide cartridges.

A dog is often helpful in locating a den; the adult coyotes become alarmed and bark or yelp when the dog nears the den.

Den hunting should be started in the early morning when coyotes are active. A good time to hunt dens is just after a rain or wind storm, as storms often restrict coyote activity.

An active den should not be left once found or the adults will move the pups. If you must leave, place a jacket or spade over the entrance to prevent the pups from leaving.

After a den is found, you should determine if pups are present. Dig away the top or uphill part of the entrance, making sure that little or no soil falls into the den. With a flashlight, examine the inside of the den. It may be necessary to remove some curves inside the runway with your spade before you can see the nest or pups.

You may also determine if pups are in shallower dens by using the probing bar. The bar is driven through the soil along the runway to the nest *(Figure 24)*. By following the runway with the bar, the nest location can be determined. Larger pups and adults may bite the bar and reveal their location.

If coyotes are present, block the den entrance to prevent their escape. All other entrance holes must be blocked or filled in with soil. Pups may be removed from the den by the following methods:

Digging - Where practical, dig out the entire nest. Young pups are easily handled, but older pups will attempt to hide in cavities or runways in the den. Therefore, the entire den should be carefully examined for pups older than 8 weeks of age.

Gassing - Pups can be gassed with carbon monoxide from a vehicle that has had the pollution control equipment removed. Insert a rubber gassing hose well into the entrance. Seal the entrance and all other holes with soil. Attach the hose to the vehicle exhaust and idle at a moderate speed for at least one hour.

A sulphur dioxide cartridge can also be used to gas a den. Ignite and place the cartridge as far into the den as possible. Seal all holes immediately. Return in 24 hours and check the den. Remove the soil slowly, as a live coyote (usually an adult) may be found at the entrance. Check to insure that there are no live coyotes in the den. Fill in the holes to prevent mishaps to passersby, livestock and machinery.

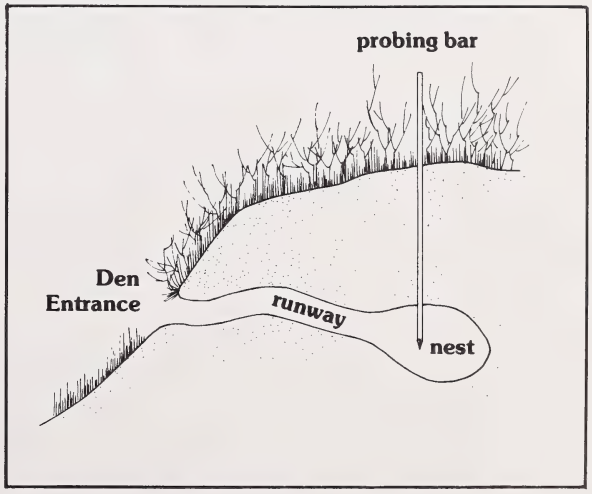


Figure 24. Cross section of a coyote den. A probe can be used to find the nest.

Adults can be removed with a trap on a path leading to the den. A "blind" set concealed along the trail with two traps a few cm apart works well. Leave as little evidence of your visit as possible and do not use bait or lures.

Research in Wyoming has shown that removing only the pups of offending adults can be nearly as effective in stopping predation losses as removing both adults and pups. Predation was reduced by 99 per cent when adults and pups were removed, and by 92 per cent when only the pups were taken. With no pups and reduced feed requirements, most adults stopped preying on livestock. Thus, it may not be worth the effort to remove the adults once the pups are gone.